Information Management

Metadata Resources Guide

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Produced by

Information Management Branch
Information Management, Access and Privacy
Alberta Government Services
3rd Floor, Commerce Place
10155 – 102 Street
Edmonton, Alberta, Canada
T5J 4L4

Web site:
www.im.gov.ab.ca
www.gov.ab.ca/foip
www.pipa.gov.ab.ca

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1. Introduction

Metadata has become a topic of interest to records and information management and technology professionals alike. Many governments are tackling the development of metadata standards to foster the effective management of electronic records and other resources and, as such, interest in metadata is increasing.

This resource guide has been created as a research tool for the Metadata Expert Working Subgroup (MEWS) to assist with the development of metadata standards for the Government of Alberta under the joint direction of the Information Management Framework Task Force and the Standards Management Committee.

It is intended for records, information management and technology professionals, consultants, library staff, and anyone who may be seeking to develop in-depth knowledge and expertise about metadata.

1.1 What Is Metadata?

Metadata has been defined as data about data, which is broadly accurate but not very helpful for understanding the complexity and power of metadata. ISO 15489-1: 2001, Information and Documentation – Records Management – Part 1: General has a more informative definition and states that metadata is "data describing context, content and structure of records and their management through time". The components of this definition highlight that metadata is used to describe various properties of records.

Metadata is composed of 'elements'. Metadata elements describe characteristics of the information object or resource. For instance, author, title and subject are well-known metadata elements. Metadata elements have standardized presentation and content in order to facilitate their interoperability and usefulness to the user of metadata. Most elements use other rules, standards, or encoding schemas to ensure consistent presentation of their content. For example, the element 'date' is generally standardized to ISO 8601 – Standard for Date Encoding that specifies dates be written as YYYY-MM-DD; or the element 'subject' is standardized to a thesaurus, such as the UNESCO Thesaurus, to ensure consistent vocabulary. Metadata elements describe the resource in a standardized way to facilitate information retrieval and handling.

In other words, metadata imposes a structure on unstructured information (i.e. documents, maps, audiovisual material, etc.) and adds more structure to already structured (i.e. database) information. The metadata structure is then exploitable for the purposes of finding information, administration, recordkeeping and preservation.

1.2 Why is Metadata Important to Government Organizations?

Beyond the clear advantages of being able to retrieve information in multiple ways, there are other benefits to using metadata especially in an electronic environment. The electronic environment offers opportunities to automate many activities, which provide for systematic, consistent and reliable handling of information. For instance, metadata may be used to automate the retention time and disposition action of information objects, to tag the security level and thus ensure access and privacy considerations are met, and finally to support other e-government initiatives.

Governments worldwide are examining how to communicate and provide services to their citizens over the Internet. These e-government initiatives are reliant upon consistent and standardized metadata, which assures that the electronic records generated are authentic, unaltered, reliable and cannot be repudiated in a court of law. Without metadata to assure the integrity of a record, e-government initiatives may be compromised.

1.3 What Are The Different Types of Metadata Standards?

There are many different metadata standards that cover varied facets of metadata function. However, two major thematic divisions are apparent. Specifically, metadata divides into those standards that may be used commonly for all resources, and metadata standards specific to a particular discipline, sector or domain.

A common metadata schema is a 'core' set (i.e. schema) of metadata elements that can be applied to all resources because they answer common functions for metadata to perform. Common metadata functions to consider are: resource discovery, administration, recordkeeping, preservation, rights management, and structural / technical. The common schema may then be supplemented with additional domain-specific schemas of metadata. The add-on nature of schemas has resulted in metadata being described as 'modular'.

Domain-specific metadata refers to metadata that is necessary only for a certain field or discipline. For instance, statistical resources would use both a common schema like Dublin Core (DC) as its 'core' metadata set, and a statistical schema to add helpful and relevant elements for searching and retrieving information, such as: "statistical population", "geographical coverage", "observation unit", etc.

The various metadata schemas are then collected and organized into schema registries to enable organizations to discover the best fitting schema for their use, and to facilitate standardization and interoperability globally.

Finally, as metadata labels or envelopes the information object, encoding standards label or envelope the metadata. Encoding standards are not metadata standards, but they affect how metadata is marked-up or coded, transmitted, accessed, and used.

1.4 Updating This Guide

The Information Management Branch of Alberta Government Services may periodically review and update this resource guide.

Please contact the Information Management Branch to offer suggestions.

2.
Recommended Introductory Resources

Getty Research Institute. Introduction to Metadata: Pathways to Digital Information [web site], 2000. Available at: http://www.getty.edu/research/institute/standards/intrometadata/index.html.

- Widely cited, this website provides authoritative articles that overview basic metadata information. It includes a glossary and metadata standards crosswalks. Crosswalks are charts, tables or databases that map or compare data elements in one standard to those in another standard.

Dublin Core Metadata Initiative (DCMI). Using Dublin Core, 2001. Available at: http://dublincore.org/documents/usageguide/.

- Dublin Core (DC) is a simple and small set of metadata elements, which forms the basis of most international metadata schemes. However, DC is recognized to only cover resource discovery kinds of metadata, and does not include metadata for preservation or recordkeeping.

Federal Geographic Data Committee (FGDC). Content Standards for Geospatial Metadata, revised 1998. Available at: http://www.fgdc.gov/metadata/contstan.html.

- Widely cited and influential geospatial metadata standard.

Schemas: Forum for Metadata Schema Implementers. Metadata Watch Report #8, April 2002. Available at: http://www.schemas-forum.org/metadata-watch/d29/d29.htm.

- Overviews worldwide progress on metadata on an irregular basis. Includes current and future metadata trends and issues, and discusses metadata from the perspective of four domains: audiovisual, cultural heritage (i.e. libraries, museums, and archives), educational, and publishing. Each domain covers its current situation, important projects, harmonization and cooperation efforts, and future work.

International Organization for Standardization (ISO). ISO 15836:2003, Information and Documentation – The Dublin Core Metadata Element Set. Available at: http://www.iso.ch/iso/en/CatalogueDetailPage.CatalogueDetail?CSNUMBER=37629&ICS1=35.

- Dublin Core became an ISO standard for resource description. It may be used in conjunction with other metadata standards that offer other semantics to create a descriptive record that contains a mix of elements drawn from various standards.

Online Computer Library Center (OCLC) / Research Libraries Group (RLG) Working Group on Preservation Metadata. Preservation Metadata for Digital Objects: A Review of

the State of the Art, 2001. Available at:
http://www.oclc.org/research/pmwg/presmeta_wp.pdf.

- The introduction states that "the creation and deployment of *preservation metadata* is likely to be a key component of most digital preservation strategies", and summarizes the "state of the art" in this review. It establishes that a preservation metadata framework should be comprehensive, structured, and broadly applicable. However, the review states that it is not necessary to start from scratch, and points to the Open Archival Information System (OAIS) reference model as a foundational work.

National Archives of Australia. Recordkeeping Metadata Standard for Commonwealth Agencies, . Available at:
http://www.naa.gov.au/recordkeeping/control/rkms/contents.html.

- This standard exemplifies the implementation of recordkeeping metadata within the Australian government. Part 1 explains the importance of and scopes the standard. Part 2 recommends and provides details on the 20 elements and 65 sub-elements to capture. The elements are organized into 6 categories that are consistent with the earlier University of Pittsburgh Functional Requirements for Evidence in Recordkeeping project.

Minnesota. Metadata [web page]. 2003. Available at:
http://www.mnhs.org/preserve/records/metadata.html.

- Provides an introduction and links to:
  - Minnesota's Metadata Guidelines,
  - Metadata Resources,
  - Metadata Recordkeeping Standard (IRM 20),
  - Metadata Studies and Reports, and
  - Powered by Metadata.

- Also, the Metadata Strategy: Minnesota State Archives (2000) is available at http://www.mnhs.org/preserve/records/metagrouprpt.pdf.

3.
Additional Background

Bearman, David et.al. A Common Model to Support Interoperable Metadata. *D-Lib Magazine* Vol. 5 (1), January 1999. Available at: http://www.dlib.org/dlib/january99/bearman/01bearman.html

- This "document represents a starting point identifying historical developments and common requirements of [Dublin Core and INDECS/DOI] perspectives on metadata and charts a path for harmonizing their respective conceptual models."

Duval, Eric, Wayne Hodgins, Stuart Sutton, and Stuart L. Weibel. Metadata Principles and Practicalities. *D-Lib Magazine* vol 8 (4), April 2002. Available at: http://www.dlib.org/dlib/april02/weibel/04weibel.html

- Identifies underlying principles for metadata schemas like modularity, and notes practicalities for developing a metadata schema. Shows the similarities between DC metadata initiative and the IEEE's (Institute for Electrical and Electronic Engineers) Learning Object Metadata Working Group.

National Information Standards Organization (NISO) Press. Metadata Made Simpler: A Guide for Libraries, 2001. By Gail Hodge. Available at: http://www.niso.org/news/Metadata_simpler.pdf.

- Introduces and explains metadata, examines the broad scope of metadata initiatives, schemas and registries, and includes a good bibliography of metadata web sites. Dublin Core, GILS, metadata creation and mapping are covered." (NISO Press)

International DOI (Digital Object Identifier) Foundation. DOI Handbook, version 3.3, 2003. Available at: http://www.doi.org/hb.html.

- DOI is the acronym for digital object identifier, and DOIs act like an ISBN or ISSN. A DOI is used as a **persistent** identifier of intellectual property. "Metadata is an essential component of the DOI system" as the identifier links the metadata to its resource. The DOI handbook contains a chapter on metadata, and also refers to the INDECS data model (See Section 7.4 of this guide entitled "E-Commerce Domain" for information on INDECS).

School of information Sciences, University of Pittsburgh. Functional requirements for evidence in recordkeeping. The Pittsburgh Project [web site]. By Richard J. Cox. Available at: http://www.archimuse.com/papers/nhprc/.

- This respected and influential project sought the electronic recordkeeping requirements necessary to ensure preservation of evidence in electronic form. This project produced many documents.

Records Continuum Research Group (RCRG). Recordkeeping Metadata Project, 2000. Available at: http://rcrg.dstc.edu.au/research/spirt/.

- Large web site links to many documents created by the RCRG, including the main deliverable Australian Recordkeeping Metadata Schema.

University of Montreal. MetaMap. 2003. Available at: http://mapageweb.umontreal.ca/turner/meta/english/index.html.

- "The MetaMap is a pedagogical graphic which takes the form of a subway map. Its aim is to help the information science community to understand metadata standards, sets, and initiatives of interest in this area."

University of Toronto. Modeling A Metalevel Ontology Project [web site]. Available at: http://www.fis.utoronto.ca/special/metadata/index.htm.

- An ongoing research project that seeks to fill the gap between machine understandable and human understandable syntax. Three research objectives are: to develop a metalevel scheme; "develop a front-end pop-up window prototype of the metalevel scheme" to help searchers navigate; and test the prototypes usefulness. The research uses eight metadata standards:
    - CIMI (Consortium for the Computer Interchange of Museum Information)
    - DC (Dublin Core)
    - DGM (Digital Geospatial Metadata)
    - EAD (Encoded Archival Description)
    - GILS (Government Information Locator Service)
    - ONIX (Online Information Exchange)
    - TEI (Text Encoding Initiative)
    - VRA (Visual Resources Association)

4.
International Metadata Initiatives and Frameworks

4.1 Australia

National Archives of Australia. AGLS Australian Government Locator Service. 2002. Available at: http://www.naa.gov.au/recordkeeping/gov_online/agls/summary.html

- Web site provides access to the AGLS Metadata Element Set.

National Archives of Australia. Recordkeeping Metadata Standard for Commonwealth Agencies (RKMS), 2000. Available at: http://www.naa.gov.au/recordkeeping/control/rkms/contents.html

- "This standard describes the metadata that the National Archives of Australia recommends should be captured in the recordkeeping systems used by Commonwealth government agencies." Part 1 explains the importance of and scopes the standard. Part 2 provides details on the 20 elements and 65 sub-elements.

Australian Government, Information Management Office (AGIMO). The Guide to Minimum Web Site Standards, Revised edition April 2003. Available at: http://www.agimo.gov.au/practice/mws.

- Consolidates and summarizes standards from many Australian jurisdictions on information provision, metadata, electronic publishing, electronic recordkeeping and archiving, web content accessibility, authentication, privacy, and security.

State Records, New South Wales. NSW Recordkeeping Metadata Standard (NRKMS), June 26, 2001. Available at: http://www.records.nsw.gov.au/publicsector/erk/metadata/rkmetadata.htm

- This technical standard was issued under the *State Records Act 1998*, and contains two parts. "Part 1: Introduction to the NSW Recordkeeping Metadata Standard" provides an overview of the metadata requirements. "Part 2: Technical Specification" describes the metadata elements, qualifiers and/or components. Recordkeeping in Brief No. 18: NSW Recordkeeping Metadata Standard summarizes important aspects of NRKMS.

Victoria, Australia. Victorian Electronic Records Strategy Final Report, 2002. http://www.prov.vic.gov.au/vers/published/final/finaltoc.htm

- Contains many sections on metadata.

Victoria, Public Record Office. VERS Metadata Scheme: PROS 99/007 Specification 2, 2000. Available at: http://www.prov.vic.gov.au/vers/standards/pros9907/99-7-2.pdf.

- The goal of the VERS Metadata Scheme is to represent the information required to preserve records over a long period.

Records Continuum Research Group (RCRG). Recordkeeping Metadata Project, 2000. Available at: http://rcrg.dstc.edu.au/research/spirt/.

- Large web site links to many documents created by the RCRG, including the main deliverable Australian Recordkeeping Metadata Schema.

4.2 Canada

Government of Alberta Web Site Standards. N.d. Available at: http://www.gov.ab.ca/pab/standards/ [web site] with the standards at http://www.gov.ab.ca/pab/standards/guidelines/guidelines_final_dec4.pdf.

- Guideline mandates only 3 elements be used on GoA websites. Specifically, title, description and keywords, which are uncontrolled or not standardized.

Government of Canada. Introduction to the Government of Canada Core Subject Thesaurus, 2001. Available at: http://dsp-psd.communication.gc.ca/Thesaurus/index-e.html.

- The "Subject Thesaurus is a bilingual standardized vocabulary designed to facilitate the indexing and retrieval of resources available on Government of Canada Web sites… [and has been] derived from the Depository Services Program (DSP) Subject Thesaurus". Subject descriptors are in both English and French.

Government of Ontario. Metadata Basic Content Requirements, 2001. Available at: http://www.gov.on.ca/mbs/techstan/tmp7300.htm.

- "This standard describes the data elements to be used when collecting and describing core content Metadata for [government of Ontario] information resources."

National Archives of Canada, Records / Document / Information Management (RDIMS) Working Group on Work Processes and Practices (WPPWG). Record Keeping Metadata Requirements for the Government of Canada, 2001. Available at: http://www.imforumgi.gc.ca/products/meta/metadata31_e.html

- This document details 26 metadata elements. Appendix A, Metadata Concordance Table compares these 26 elements to DC and CLF (Canadian Look and Feel).

National Library of Canada. Canadian GILS guidelines: Guidelines for the Preparation of Government Information Locator Service (GILS) Records, 1998. Available at: http://collection.nlc-bnc.ca/100/200/301/nlc-bnc/cdn_gils_guidelines-e/gils-e.pdf.

- Canadian GILS examines the same basic elements as DC and also assigns properties to a resource: mandatory / optional, repeatable / not repeatable, and controlled / not controlled, plus another property of grouping element / non-grouping element.

National Library and Archives of Canada. Government of Canada Metadata Implementation Guide for Web Resources, 2nd edition, May 2003. Available at: http://www.collectionscanada.ca/6/37/s37-4016-e.html.

- Assists web developers in implementing the Canadian Look and Feel standard.

Treasury Board of Canada Secretariat. Common Look and Feel for the Internet, Updated 2004. Available at: http://www.cio-dpi.gc.ca/clf-nsi/index_e.asp.

- This document specifies many aspects for managing web content, including Standard 6.3 Metatags, which require creator, date, language, subject and title elements.

Treasury Board of Canada Secretariat. Government of Canada Internet Guide, 2002. Available at: http://www.cio-dpi.gc.ca/ig-gi/index_e.asp.

- Provides how-to advice for managing Internet resources from getting started (marketing, hiring the Web team) to implementation, evaluation, and maintenance. Contains a section on metadata.

Treasury Board of Canada Secretariat. IMRC – Metadata. 2003. Available at: http://www.cio-dpi.gc.ca/im-gi/meta/meta_e.asp.

- Portal to the Canadian government's collection of metadata resources. This web page provides access to metadata topics, metadata web pages published by other federal Canadian agencies, and international metadata resources.

4.3 Denmark

Danish National Library Authority. Dublin Core in Denmark, June 1999. Available at: http://www.bs.dk/metadata/english.htm.

- Denmark was the first country to require DC-based metadata resource description. This paper discusses modifications made to DC.

OIO, InfrastructureBase Facilitating Integration. Publications Rules and Guidelines [web site]. 2003. Available at: http://isb.oio.dk/info/publications/index.htm.

- Covers XML usage for e-government, including metadata. The website provides guidance or publications on implementation, standardization, modeling, XML schema, and integration in order to support the registration of documents from participating organizations.

4.4 Ireland

The Irish Public Service Metadata Standard (IPSMS), Version 1. 0. Part 1 Framework, 2001. Available at: http://www.gov.ie/webstandards/metastandards/ipsms_part1.pdf.

- Defines what metadata is, describes Ireland's process to develop a metadata standard, and the management and use of the standard.

The Irish Public Service Metadata Standard, Version 1. 0. Part 2 Element Set and Implementation, 2001. Available at: http://www.gov.ie/webstandards/metastandards/ipsms_pt2.pdf.

- This Standard is based on Dublin Core, and specifies elements, qualifiers, encoding schemas, and implementation. Part 1 is a Word document available through the User Guide portal listed directly below.

The Irish Public Service Metadata Standard: User Guide Version 1.1, June 2002. Available at: http://www.gov.ie/webstandards/metastandards/index.html.

- A handy portal to guidance and information on the IPSMS.

4.5 The Netherlands

Smit, Frans. The Historical Data Warehouse, 2002. Available at: http://www.cultivate-int.org/issue6/warehouse/.

- Adapts concepts from other theories on knowledge management and communications to metadata for the historical data warehouse.

4.6 New Zealand

New Zealand. New Zealand Government Locator Service (NZGLS) Standard and Reference Manual. Version 2, 2001. Available at: http://www.e-government.govt.nz/docs/nzglsv2/.

- This standard is based on the Australian Government Locator Service extension of DCMI (the Dublin Core Metadata Initiative). A Metalogue Checklist provides a charted summary of the elements. Furthermore, a Compliance Study was initiated to evaluate the standard.

New Zealand. Metadata Management Facility User Requirements Specifications, 2001. Available at: http://www.e-government.govt.nz/docs/mmf-users/index.html.

- This document supports metadata collection and creation across various government agencies. Contains chapters on a business process model, process descriptions, metadata repository and search engine, and technical requirements.

4.7 United Kingdom

Office of the e-Envoy. e-Government: E-government Metadata Framework, May 2001. Available through: http://www.e-envoy.gov.uk/assetRoot/04/00/27/23/04002723.pdf.

- "The e-Government Metadata Framework (e-GMF) sets out the Government's policies for establishing and implementing metadata standards across the public sector. "

Office of the e-Envoy. e-Government Metadata Standard (e-GMS), April 2002. Available through: http://www.e-envoy.gov.uk/assetRoot/04/00/09/73/04000973.pdf .

- "The e-Government Metadata Standard lays down the elements, refinements and encoding schemes to be used by government officers when creating metadata for their information resources or designing search systems for information systems". Element definitions have been based on Dublin Core, and were also compared against DC, AGLS, NGDF, GILS, and PRO. This standard does not cover implementation or technical issues.

Office of the e-Envoy. Government Category List (GCL). 2001. Available at: http://www.govtalk.gov.uk/schemasstandards/gcl.asp.

- "The GCL is a classified list of headings for use with the Subject element of the e-GMS".

4.8 United States

Minnesota. Electronic Records Management Guidelines, version 4.0, 2004. Available at: http://www.mnhs.org/preserve/records/electronicrecords/erguidelinestoc.html.

- Contains a chapter on metadata implementation that overviews the use of DC, geospatial and recordkeeping metadata in the Government of Minnesota. This guideline also highlights that geospatial information is an important type of government information, and that geospatial metadata is a necessary component of government metadata.

Minnesota. Metadata Strategy: Minnesota State Archives, 2000. Available at: http://www.mnhs.org/preserve/records/metagrouprpt.pdf

- Provides a high-level overview of the metadata strategy in Minnesota.

Minnesota. Minnesota Recordkeeping Metadata Standard (IRM 20), May 2002. Available at: http://www.mnhs.org/preserve/records/metadatastandard.html.

- This standard shares many elements with other metadata standards, and also addresses the issues of access restrictions, data practices, and records retention and disposition, thereby enabling records management.

U.S. Geological Survey. Government Information Locator Service (GILS) Overview: Ideas Behind the GILS Approach, N.d. Available at: http://www.gils.net/overview.html.

- This document provides an excellent explanation about GILS, and is located with many other informative resources on the GILS web site.

University of Michigan. DDI, Data Documentation Initiative: A Project of the Social Science Community, 2002. Available at: http://www.icpsr.umich.edu/DDI/.

- "The Data Documentation Initiative (DDI) is an effort to establish an international criterion and methodology for the content, presentation, transport, and preservation of "metadata" about datasets in the social and behavioral sciences."

4.9 Europe

Helsinki University Library. The Nordic Metadata Project, 2000. Available at: http://www.lib.helsinki.fi/meta/index.html.

- "Nordic metadata projects create tools for creating, harvesting, indexing and converting Dublin Core metadata." This Web site contains the Nordic Metadata Project: Final Report.

Open Archives Initiative [web site]. Available at: http://www.openarchives.org/.

- Web site's core documents are The Open Archives Initiative Protocol for Metadata Harvesting and its Implementation Guidelines.

European Committee for Standardization and Information Society Standardization System (CEN / ISSS CEN/ISSS Metadata Framework, 1999. Available at: http://dialspace.dial.pipex.com/town/way/gkh12/frame/main.html.

- The framework provides a structured classification of European metadata activities. Organizes the metadata field according to various sub-groupings.

Metadata Standards, ISO/EIC JTC1 SC32 WG2 [web site]. Available at: http://metadata-stds.org/.

- This new web site looks promising but as yet has not developed a great deal of content. The web site states that it has scheduled improvements for December 2002.

ISO, International Standards Organization. ISO 8459-5:2002. Information and Documentation -- Bibliographic Data Element Directory -- Part 5: Data Elements for the Exchange of Cataloguing and Metadata, 2002. Available at: http://www.iso.org/iso/en/CatalogueDetailPage.CatalogueDetail?CSNUMBER=27176&ICS1=35&ICS2=240&ICS3=30.

ISO. ISO/IEC AWI 19773-1. Information Technology -- MetaData Registries (MDR) -- Part 1: Contact Information Module for Metamodel, 2002. Available at: http://www.iso.ch/iso/en/stdsdevelopment/techprog/workprog/TechnicalProgrammeProjectDetailPage.TechnicalProgrammeProjectDetail?csnumber=33911

- This is a new project in the preparatory stage.

ISO 15836:2003, Information and Documentation – The Dublin Core Metadata Element Set. Available at: http://www.iso.ch/iso/en/CatalogueDetailPage.CatalogueDetail?CSNUMBER=37629&ICS1=35.

- Dublin Core became an ISO standard for resource description. It may be used in conjunction with other metadata standards that offer other semantics to create a descriptive record that contains a mix of elements drawn from various standards.

ISO. ISO/PDTR 23081. Information and Documentation – Records Management Processes – Metadata for Records – Part 1: Principles [draft]. 2004. Available at: http://www.iso.ch/iso/en/stdsdevelopment/techprog/workprog/TechnicalProgrammeProjectDetailPage.TechnicalProgrammeProjectDetail?csnumber=36627

- As yet this draft standard is not published.

Danish State Information Service. The European Approach to Metadata, 2001. Prepared by Makx Dekkers of AMI Consult. Available at: http://www.oio.dk/files/D2_Final_2001-10-31.pdf.

- Investigates various approaches taken by European nations.

5.
Metadata Functionalities

5.1 Administration

Dublin Core Metadata Initiative (DCMI). DCMI Administrative Metadata Working Group. Available at: http://dublincore.org/groups/admin/.

- The final version of the AC – Administrative Components – Dublin core DCMI Administrative Metadata, 2003 is a tool to manage metadata, and which focuses on interoperability between different systems.

5.2 Preservation

University of Leeds. Cedars Guide to: Preservation Metadata, 2002. Available at: http://www.leeds.ac.uk/cedars/guideto/metadata/.

- This guide explains the necessity for preservation metadata, broadly overviews the OAIS Reference Model that Cedars follows, describes Cedars main metadata elements, and makes recommendations.

National Library of Australia. Preservation Metadata for Digital Collections. 1999. Available at: http://www.nla.gov.au/preserve/pmeta.html.

- This exposure draft proposes a set of metadata for preservation purposes.

OCLC/RLG Preservation Metadata Working Group [web site]. Available at: http://www.oclc.org/research/projects/pmwg/wg1.htm.

- This web site includes the papers: Preservation Metadata and the OAIS Information Model: A Metadata Framework to Support the Preservation of Digital Objects (2002), and Preservation Metadata for Digital Objects: A Review of the State of the Art (2001).

The Society of American Archivists (SAA), Task Force on Electronic Publishing. Final Report, 2002. Available at: http://www.archivists.org/saagroups/taskforces/tfep-finalreport.pdf.

- Contains information regarding preservation metadata.

5.3 Recordkeeping

Archiefschool (Dutch Archives School). Archiving Metadata Forum, June 5-8, 2000 at The Hague, Netherlands. Available at: http://www.archiefschool.nl/engels.htm.

- Workshop proceedings are entitled, Recordkeeping metadata" workshop: Proceedings of the Archiving Metadata Forum (draft). Web site also includes many authoritative articles.

Dublin Core Metadata Initiative (DCMI). DCMI Government Working Group [web site], 2002. Available at: http://dublincore.org/groups/government/.

- This web site includes an article and qualifier proposals:

  International Recordkeeping / Records Management Metadata Initiatives: Report and Recommendations for DC Advisory Board, 2002 [article]. Discusses resource management metadata as a strong interest to governments, and considers roles for

  DCMI to respond to resource management needs.
  Proposal: Access Rights qualifier for Rights element.
  Proposal: Acquired qualifier for Date element.
  Proposal: Security classification qualifier for Rights element.

ISO TC46-SC11 TR 23081. Information and Documentation – Records Management Processes – Metadata for Records - Principles. Available at: http://www.iso.ch/iso/en/stdsdevelopment/techprog/workprog/TechnicalProgrammeProjectDetailPage.TechnicalProgrammeProjectDetail?csnumber=36627.

- ISO is developing a metadata standard to comply with ISO 15489 Parts 1 and 2.

5.4 Resource Discovery

See section 6 for Common Metadata Schemas.

5.5 Rights Management

Rust, Godfrey, MUZE, and Mark Bide, EDItEUR. The <indecs> Metadata Framework: Principles, Model and Data Dictionary, 2000. Available at: http://www.indecs.org/pdf/framework.pdf.

- <indecs> Interoperability of Data in E-Commerce Systems focuses on metadata for intellectual property and commercial transactions. Discusses object identifiers and supporting metadata contained within a framework in order to manage intellectual property rights.

Bide, Mark, EDItEUR. Directory of Parties: Outline Specification, 1999. Available at: http://www.indecs.org/pdf/DirectoryofParties.pdf.

- "The effective operation of electronic commerce in intellectual property rights requires that those who create intellectual property and/or actively participate in those rights (as owner, administrator or licensee – "agent" in <indecs> terminology) can be unambiguously identified".

World Intellectual Property Organisation (WIPO). Electronic Commerce and Copyright: A Key Role for WIPO. 1999, 2000. By Mrs. Tarja Koskinen-Olsson. Available at: http://www.wipo.int/eng/meetings/1999/acmc/2_1toc.htm.

- Includes information on metadata schemes.

World Wide Web (W3C). XML Digital Signatures Activity Statement. 2002. Available at: http://www.w3.org/Signature/Activity.

- "RDF may be used to express information concerning what you are signing, what the significance of the signature is, the dates that the signature is valid, and so on."

5.6 Structural and Technical

University of Berkeley. The Making of America II: Testbed Project White Paper, Version 2.0. 1998. Available at: http://sunsite.berkeley.edu/moa2/wp-v2.html.

- Part III of this white paper defines structural metadata as that which aids in the presentation of the resource. Part III also presents tables of structural elements.

  Technical data elements are also assigned in the Film, Image and Multimedia domain (See Section 7.5). Technical metadata is defined in the imaging domain as that used to "objectively measure" characteristics, such as detail, tone, color and size (NISO and AIIM).

Object Management Group (OMG). CWM, Common Warehouse Metamodel. 2001. Available through: http://www.omg.org/technology/cwm/.

- "The Common Warehouse Metamodel (CWM™) is a specification that describes metadata interchange among data warehousing, business intelligence, knowledge management and portal technologies."

W3C. Semantic Web Activity Statement [web page]. Available at: http://www.w3.org/2001/sw/Activity.

- W3C's Metadata Activity was replaced with the Semantic Web Activity.

6.
Common Metadata Schemas

6.1 Anglo-American Cataloguing Rules, AACR2

National Library of Canada. The logical structure of the Anglo-American Cataloguing Rules – Part I, 1998. Available at: http://www.nlc-bnc.ca/jsc/aacr.pdf.

- Schema defines terminology, elements and attributes that also may be useful for a metadata initiative. Details how agents, processes and objects are described in a bibliographic record.

National Library of Canada. The logical structure of the Anglo-American Cataloguing Rules – Part II, 1998. Available at: http://www.nlc-bnc.ca/jsc/aacr2.pdf.

- Diagrams how agents, processes and objects are "taken into account to determine choice of access points".

6.2 Dublin Core, DC

Dublin Core Metadata Initiative Web Site. Available at: http://dublincore.org/index.shtml.

- The DCMI Elements and Element Refinements – a current list (2002) defines the elements based on a standard set of attributes. DC also has a guide entitled, Using Dublin Core, and a sub-site for the DCMI-Government Working Group, which contains the DC-Gov Application Profile.

Lagoze, Carl. Keeping Dublin Core Simple: Cross Domain Discovery or Resource Description. D-Lib Magazine Vol 7 (1), Jan 2001. Available at: http://www.dlib.org/dlib/january01/lagoze/01lagoze.html.

- This paper argues for using simple statements about resources, rather than for more descriptive and complex DC.

6.3 Encoded Archival Description, EAD

Society of American Archivists, and the Library of Congress. Application Guidelines for Version 1.0. 1999. Available at: http://lcweb.loc.gov/ead/ag/aghome.html.

- This standard supports the publication of EAD finding aids on the Internet. EAD finding aids provide greater detail and are intended to supplement collection-level MARC catalog records.

6.4 Government Information Locator Service, GILS

See jurisdictional sections 4.1 to 4.9 to view existing GILS schemas.

6.5 Text Encoding Initiative (TEI)

Burnard, Lou and C. M. Sperberg-McQueen. TEI Lite: An Introduction to Text Encoding for Interchange. Revised 2002. Available at: http://www.tei-c.org/Lite/index.html.

- TEI is used to markup text inside a document. It is both a metadata standard and encoding standard for either SGML or XML.

6.6 Crosswalking (Element Mapping)

Crosswalking refers to mapping or comparing elements from common schemas.

Getty Research Institute. Introduction to Metadata: Pathways to Digital Information: Metadata Standards Crosswalk, 2000. Available at: http://www.getty.edu/research/institute/standards/intrometadata/3_crosswalks/index.html

- Provides charts to compare the elements of common metadata standards', such as: DC, EAD, USMARC, and ISAD(G).

Library of Congress. Functional Analysis of MARC 21 Bibliographic and Holdings Format, 2002. Available at: http://www.loc.gov/marc/marc-functional-analysis/source/analysis.pdf.

- Maps MARC's data elements to FRBR and AACR2.

Library of Congress, Network Development and MARC Standards Office. Dublin Core/MARC/GILS Crosswalk, April 2001. Available at: http://lcweb.loc.gov/marc/dccross.html

- Maps DC to MARC and GILS.

NISO Standards. Issues in Crosswalking: Content Metadata Standards,1998. By Margaret St. Pierre and William P. LaPlant, Jr. Available at: http://www.niso.org/press/whitepapers/crsswalk.html

- Crosswalks harmonize metadata standards, which facilitates the development of standards. "This paper distills the key issues involved in crosswalk development and identifies those areas in which harmonization can contribute."

7.
Domain or Sector Specific Metadata

7.1 Geospatial Metadata Standards

ANZLIC, The Spatial Information Council. ANZLIC Metadata Guidelines: Core Metadata Elements for Geographic data in Australia, 2002. Available at: http://www.anzlic.org.au/asdi/metaclem.htm

- Intended to assist data custodians create, store and distribute core metadata elements.

Federal Geographic Data Committee (FGDC). Metadata [web site], 2002. Available at: http://www.fgdc.gov/metadata/metadata.html.

- This web site contains the widely cited Content Standards for Geospatial Metadata (Revised 1998); the Content Standard for Digital Geospatial Metadata Workbook (2000), and a brief overview entitled Geospatial Information One-Stop.

U.S. Geological Survey (USGS). Tools for Creation of formal metadata: Frequently asked questions for FGDC metadata, 2002. Available at: http://geology.usgs.gov/tools/metadata/tools/doc/faq.html.

- FAQ contains sections on: motivation, metadata standard, metadata file format, metadata storage and management, metadata dissemination, etc.

Government of Ontario. Geospatial Metadata Basic Content Requirements, 1999. Available at: http://www.gov.on.ca/mbs/techstan/tmp7200.htm.

- This standard describes data elements for geographic information resources.

Minnesota. Minnesota Geographic Metadata Guidelines, Version 1.2, 1998. Available at: http://www.gis.state.mn.us/stds/metadata.htm.

- Provides a brief introduction, and then links to a chart that summarizes geospatial metadata elements. This resource outlines the scope of the geospatial domain's metadata requirements. It documents all types of geographic data.

Minnesota. Bridges: Minnesota Metadata Guidelines – Dublin Core [MMG – DC] [web site]. Available at: http://bridges.state.mn.us/metadata.html.

- The Minnesota Metadata Project adapted the Dublin Core elements and embeds metadata within their Web pages. A Training Manual provides explanations and greater detail.

Open GIS Consortium. Topic 11: Metadata, 1998. Available at: http://www.opengis.org/docs/01-111.pdf and through http://www.opengis.org/specs/?page=abstract.

- This consortium has produced standards and many other white papers (See Press – White Papers).

7.2 Agricultural Domain

United Nations. FAO. The Agricultural Metadata Standards Initiative, 2001. Available at: http://www.fao.org/agris/AgMES/default.htm.

- This Web site links to metadata specifications, which are based on Dublin Core.

7.3 Content Ratings Domain

W3C. Platform for Internet Content Selection (PICS), 2001. Available at: http://www.w3.org/PICS/.

- "It was originally designed to help parents and teachers control what children access on the Internet, but it also facilitates other uses for labels, including code signing and privacy." Includes PICS Rating Vocabularies in XML / RDF (2001), and the Statement on the Intent and Use of PICS: Using PICS Well (1998).

7.4 Education Domain

Institute of Electrical and Electronics Engineers (IEEE). Draft Standard for Learning Object Metadata, 2002. Available at: http://ltsc.ieee.org/wg12/files/LOM_1484_12_1_v1_Final_Draft.pdf.

- "This Standard is a multi-part standard that specifies Learning Object Metadata." Metadata for an object is described by characteristics, which are grouped in life cycle, meta-metadata, educational, technical, rights, relation, annotation, and classification categories."

7.5 Film, Image and Multimedia Domain

ECHO's Metadata Modeling Report, 2000. Available through: http://pc-erato2.iei.pi.cnr.it/echo/workpackages/wp3.html. Scroll to bottom of webpage to "Public Deliverables".

- Metadata model for film.

International Imaging Industry Association (I3A). DIG35 Metadata Specification Version 1.1. Available at: http://www.i3a.org/i_dig35.html.

- Defines metadata for digital images and recommends use of XML.

Moving Pictures Experts Group. ISO/IEC JTC1/SC29/WG11. Coding of Moving Pictures and Audio. MPEG-21 Overview v.5. October 2002. Available at: http://www.chiariglione.org/mpeg/standards/mpeg-21/mpeg-21.htm.

- The Moving Picture Experts Group (MPEG) is a working group of ISO/IEC. "MPEG-21 identifies and defines the mechanisms and elements needed to support the multimedia delivery chain".

National Information Standards Organization (NISO) and AIIM International. NISO Z39.87-2002, AIIM 20-2002, Data Dictionary – Technical Metadata for Digital Still Images, Draft, 2002. Available at: http://www.niso.org/standards/resources/Z39_87_trial_use.pdf.

- "Two overarching goals led NISO and AIIM to develop this data dictionary. The first is to identify the data elements that would be used by applications to control transformations of images against stated metrics (or "anchors") for meaningful quality attributes such as detail, tone, color, and size. The second is to propose elements that would be used by digital repository managers, curators, or imaging specialists to assess the current value (aesthetic or functional) of a given image or collection of images."

UKOLN. Metadata for Images: A Report for the Filter Project, 2002. Available at: http://www.ukoln.ac.uk/metadata/filter/report/report.html.

- Focusing Images for Learning and Teaching – an Enriched Resource (FILTER) reports on the main categories of metadata that images require.

7.6 Library Domain

International Federation of Library Associations and Institutions (IFLA). Functional Requirements for Bibliographic Records, 1998. Available at: http://www.ifla.org/VII/s13/frbr/frbr.htm.

- Widely cited and influential, this standard has informed many other standards, such as DC and Indecs/DOI. It contains sections on: entities, attributes, relationships, and user tasks.

7.7 Machine Understandable Domain

UKOLN. Accessibility Metadata, 1999. Available at: http://www.ukoln.ac.uk/web-focus/accessibility/metadata/.

- Focuses on machine-understandable metadata that supports accessibility.

7.8 Biological and Ecological Domain

United States. The National Biological Information Infrastructure Metadata Homepage, 2001. Available at: http://www.nbii.gov/datainfo/metadata/.

- Metadata "descriptions convey such things as content, quality, lineage, contact, and other characteristics." Additionally, the web site contains a standards page that links to many useful documents, including the Biological Data Profile.

Arizona State University. Central Arizona – Phoenix Long Term Ecological Research Program (CAPLTER) [web site]. Available at: http://caplter.asu.edu/home/index.jsp.

- This ecological metadata web site includes the key document entitled Research Metadata in Long-Term Ecological Research (LTER).

Ecoinformatics.org: An Online Data and Information Management Resource for Ecologists, 2002. Available at: http://www.ecoinformatics.org/.

- "Ecoinformatics.org is an open, voluntary collaboration of developers and researchers that aims to produce software, systems, publications, and services that are beneficial to the ecological and environmental sciences."

7.9 Statistical Domain

Statistical Data and Metadata Exchange (SDMX). Projects [web site]. Available at: http://www.sdmx.org/General/Projects.htm.

- SDMX is a "task force initiated by BIS, ECB, IMF, OECD, EUROSTAT, and UN to address standardization of the exchange of statistical information." Includes a recent paper entitled, Common Open Standards for the Exchange and Sharing of Socio-economic Data and Metadata: the SDMX Initiative.

United Nations Economic Commission for Europe. Statistical Metadata Publications [web page]. Available at: http://www.unece.org/stats/publ.e.htm.

- Provides access to:
- Terminology on Statistical Metadata (No. 53, 2000),
- Guidelines for Statistical Metadata on the Net (No. 52, 2000), and
- Guidelines for the modeling of Statistical Data and Metadata (1995).

8.
Encoding Formats

8.1 HyperText Markup Language, HTML

Dublin Core. Recording Qualified Dublin Core Metadata in HTML Meta Elements. 2000. Available at: http://dublincore.org/documents/dcq-html/.

- Describes and explains how to record qualified Dublin Core using HTML <meta> elements in the document <head>.

8.2 Machine Readable Cataloguing, MARC

Library of Congress (LC). MARC Standards [web site]. Available at: http://www.loc.gov/marc/.

- Web site provides access to many documents including MARC in XML.

8.3 Metadata Encoding and Transmission Standard, METS

LC. Metadata Encoding & Transmission Standard (METS), 2001. Available at: http://www.loc.gov/standards/mets/.

- Web site states that METS uses XML for encoding descriptive, administrative, and structural metadata for objects within a digital library.

8.4 Resource Description Framework, RDF

Ianella, Renato. An Idiot's Guide to the Resource Description Framework, 1999. Available at: http://www.dstc.edu.au/Research/Projects/rdf/RDF-Idiot.html.

- The Resource Description Framework (RDF) - developed by the World-Wide Web Consortium (W3C) - provides the foundation for metadata interoperability across different resource description communities. This document describes and explains RDF with practical examples.

World Wide Web Consortium (W3C). RDF Primer, 2002. Available at: http://www.w3.org/TR/2002/WD-rdf-primer-20020426/.

- "This Primer is designed to provide the reader the basic fundamentals required to effectively use RDF in their particular applications."

W3C. Web Architecture: Describing and Exchanging Data, June 7, 1999. Available at: http://www.w3.org/1999/04/WebData

- Discusses the convergence of RDF and XML schemas.

8.5 Extensible Markup Language, XML

Garshol, Lars Marius. An Introduction to XML, 1999. Available at: http://www.garshol.priv.no/download/text/xml-intro/index-en.html.

- Explains that XML is simplified SGML, which allows the user to define their own mark-up language and thus to encode much more specifically.

Dublin Core Metadata Initiative. Guidelines for Implementing Dublin Core in XML. 2003. Available at: http://dublincore.org/documents/2003/04/02/dc-xml-guidelines/.

- Provides guidelines for implementing DC in XML.

Lightle, Kimberly S. and Judith S. Ridgway. Generation of XML Records Across Multiple Metadata Standards. D-Lib Magazine 9 (9), September 2003. Available at: http://www.dlib.org/dlib/september03/lightle/09lightle.html.

- Describes the process to develop crosswalks between USMARC, IEEE LOM, and DC-ED and the generation of XML records.

Ray, Eric T. Learning XML: (Guide to) Creating Self-Describing Data. Chapter 2: Markup and Core Concepts, 2001. Available at: http://www.oreilly.com/catalog/learnxml/chapter/ch02.html.

- This chapter "describes the fundamental building blocks of all XML-derived languages: elements, attributes, entities, and processing instructions."

Sun Microsystems. XML: Document and Information Management, N.d. Available at: http://www.sun.com/980908/xml/.

- Introductory article.

W3C. Extensible Markup Language (XML), 2002. Available at: http://www.w3.org/XML/.

- Web site lists working documents and recommendations chronologically. Includes an XML Schema Part 0: Primer (2001).

United Kingdom, Cabinet Office, Ukgovtalk. XML Schemas [web site]. Available at: http://www.govtalk.gov.uk/schemasstandards/xmlschema.asp.

- This site defines common data definitions as XML schemas.

8.6 Z39.50

National Information Standards Organization (NISO). Z39.50 A Primer on the Protocol, 2002. Available at: http://www.niso.org/standards/resources/Z3950_primer.pdf.

- "Z39.50 enables two computer systems on a network to communicate for the purpose of information retrieval." It enables the use of metadata to find and retrieve information.

9.
Metadata Tools

DC. Tools and Software. Available at: http://dublincore.org/tools/.

- This Web site contains: utilities, templates, automation tools, conversion tools, and software. Includes search engine software for metadata utilization.

Heery, Rachel and Harry Wagner. A Metadata Registry for the Semantic Web, 2002. Available at: http://www.dlib.org/dlib/may02/wagner/05wagner.html.

- Examines the role of metadata registries and three DC prototypes.

Europa. Eurovoc Thesaurus, Version 3.1. Available at: http://europa.eu.int/celex/eurovoc/cgi/sga_doc?eurovoc_dif!SERVEUR/menu!prod!MENU&langue=EN.

- Thesaurus defines terminology to use for identifying the subject of an electronic resource in government. Refer to the "Navigating in the Thesaurus" web page for a break down of government terms.

Dublin Core Metadata Initiative (DCMI) Metadata Registry [web site]. Available at: http://dublincore.org/dcregistry/.

- Provides for the discovery and re-use of existing metadata terms and definitions.

United Nations Educational, Scientific and Cultural Organization (UNESCO). UNESCO Thesaurus. Available at: http://www.ulcc.ac.uk/unesco/.

- This subject-based thesaurus that is linked together by hierarchical, associative, and equivocal relationships. It may be purchased in English, Spanish and French versions.

National Archives of Australia. AGLS – Compliant Authoring Tools [portal website]. 2000. Available at: http://www.naa.gov.au/recordkeeping/gov_online/agls/tools.html

- Lists and describes several commercial software tools.

10.
Keeping Up-To-Date

10.1 Portals or Subject Gateways

International Federation of Library Associations and Institutions (IFLA). IFLA. Digital Libraries: Metadata Resources, Latest revision, 2003. Available at: http://www.ifla.org/II/metadata.htm.

- This comprehensive resource guide contains current and historical links to metadata resources.

IMRC – Metadata. Available at: http://www.cio-dpi.gc.ca/im-gi/meta/meta_e.asp.

- Federal, Canadian portal to metadata in government agencies and internationally.

Minnesota Historical Society. Metadata Resources, 2002. Available at: http://www.mnhs.org/preserve/records/metadataresources.html.

- Lists and describes core metadata standards, projects, tools and conferences.

National Library of Australia. Meta Matters, 1999. Available at: http://dcanzorg.ozstaging.com/mb.aspx.

- Provides guidance and links to metadata resources.

National Library of Australia. Preserving Access to Digital Information (PADI): Metadata, 2002. Available at: https://www.nla.gov.au/padi/topics/30.html.

- Annotated list of links to current and historical metadata information from authoritative sources and projects.

Testbed Digitale Bewaring . Kennisbank / Knowledge Bank: Metadata. Available at: http://www.digitalebewaring.nl/index.cfm?paginakeuze=58&categorie=2.

- Provides list of links to metadata and XML papers.

UKOLN Metadata, 2003. Available at: http://www.ukoln.ac.uk/metadata/.

- Excellent list of links to current metadata information.

10.2 Listservs

Dublin Core Mailing Lists. Available at: http://dublincore.org/groups/mailinglists.shtml.

Encoded Archival Description (EAD) Electronic List. Available at: http://www.loc.gov/ead/eadlist.html.

IEEE, Learning Technology Standards Committee (LTSC) Working Committees' Discussion Lists. Available through: http://ltsc.ieee.org/index.html. Select the working group of interest and follow subscription information on the web page.

10.3 Newsletters

Search Engine Watch. Available at: http://searchenginewatch.com/.

- This web site provides information on search engines' usage of metadata.

10.4 Conferences

Canadian <Metadata> Forum, September 19 – 20, 2003. Available at: http://www.collectionscanada.ca/metaforum/n11-201-e.html.

Dublin Core Conferences. Available at: http://dublincore.org/workshops/

OMG Technology Workshops Proceedings. Available at: http://www.omg.org/news/meetings/workshops/proceedings.htm.